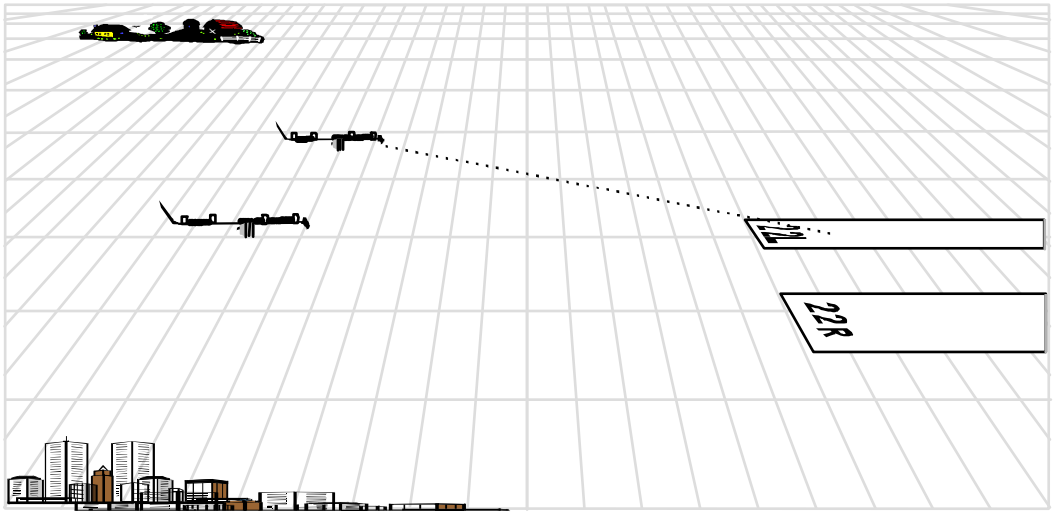
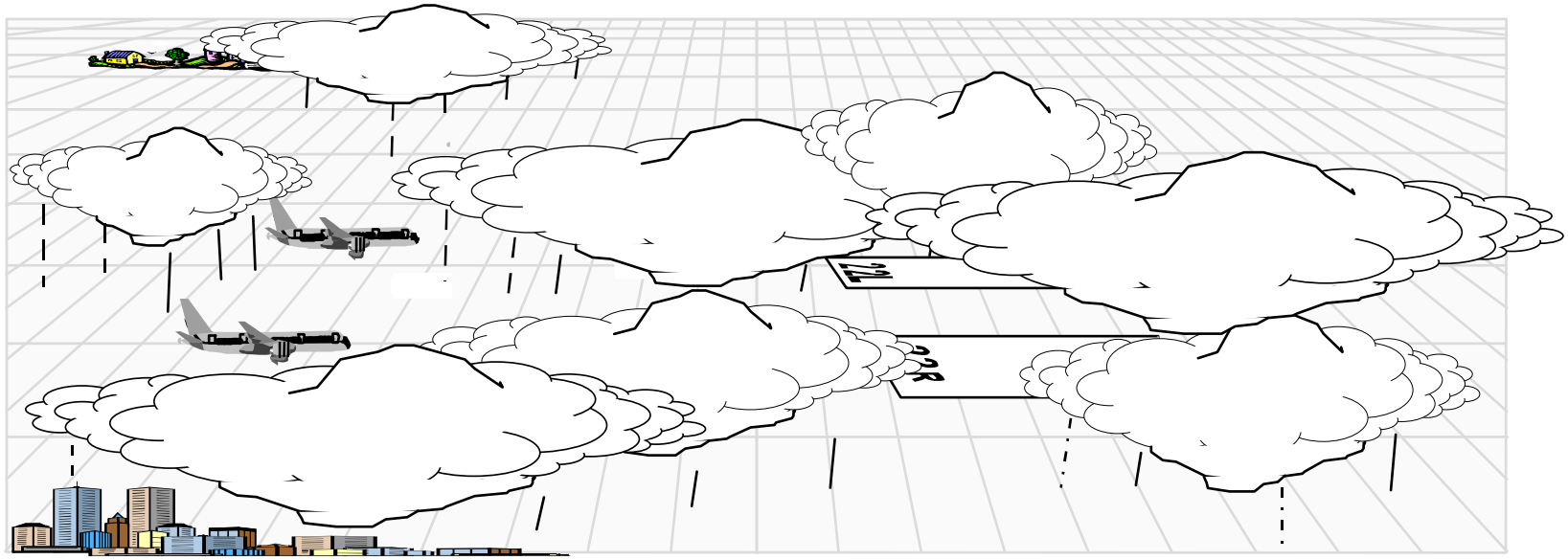
Airborne Information for Lateral Spacing (AILS)

Technology for approaches to closely spaced parallel runways



Marvin Waller
May 14, 1998
Presented to:
The Closely Spaced Parallel Runway SG
RTCA SC-186 WG1



Problem Statement

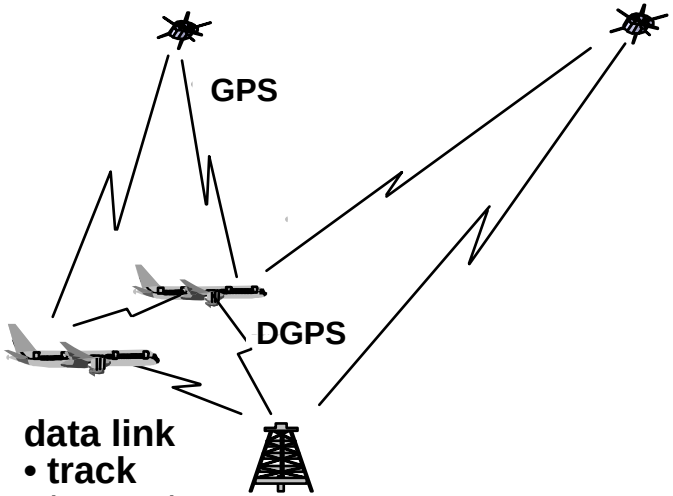
Capacity of closely spaced parallel runway operations is significantly reduced under low visibility conditions.

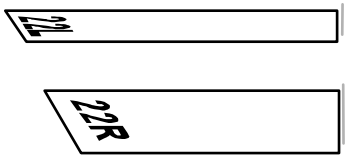
- **Approximately 35 existing airports have close parallels, including six of the ten busiest U.S. airports**
- **Ground based technology supports down to 4300 ft. spacing (3400 ft. with Precision Runway Monitoring, PRM)**

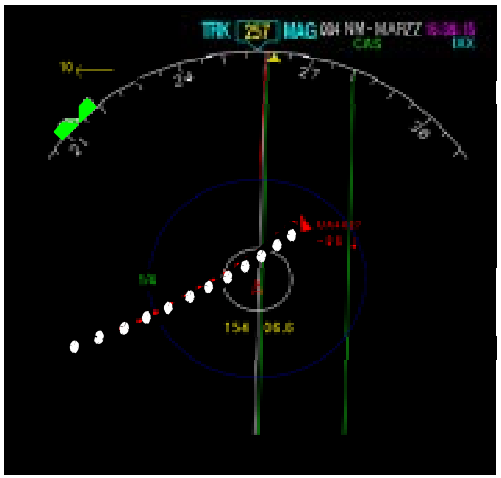
The NASA Concept
Airborne Information for Lateral Spacing (AILS)

Two elements of AILS flight deck centered technology aid pilots in:

- **accurate flight path management**
- **conflict detection, alerting and resolution**

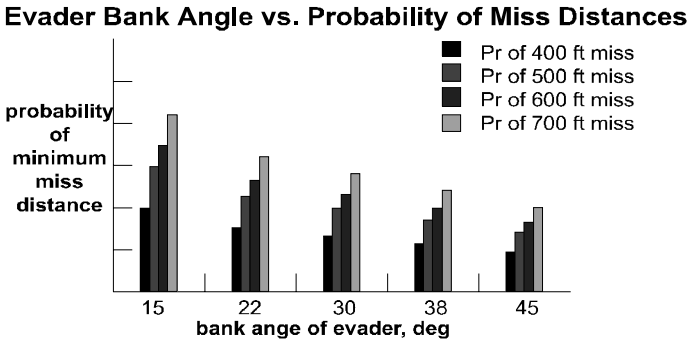






Major Activities Completed to Date

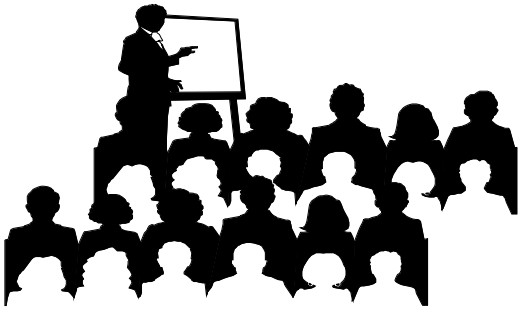
Concept development supported by Monte Carlo model parametric studies



Simulation studies of 4300 to 1200 ft. runway spacing operations.

NASA B737 flight test to establish lateral flight path management accuracy.

Workshop to disseminate results. Strong interest generated.

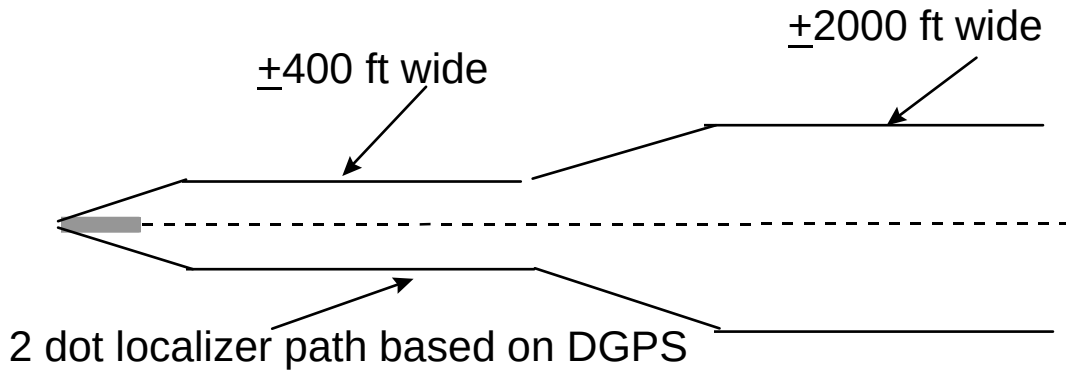


Flight Test to Establish Lateral Tracking Accuracy

- 13 flights
- 2 pilots
- manual
- no autothrottle

- Wallops
- mod. turbulence
- 15 knot winds
- 6 runway directions

Lateral Path Control



- 99.7% of time within one dot localizer
- pilots reported no difficulty in flying path

AILS ATC Integration

- **AILS ATC Study Team**
  - **Developed detailed description of ATC interaction / operational concept**
  - **Prepared draft document for industry, customer, and stakeholders review**

    (Early draft reviewed by FAA AND-450)
  - **Compiled data base to support determination of AILS applicability to U.S. airports**
- **AILS ATC Planning Team**
  - **Developed plan to implement ATC study team recommendations in ATC-focused simulation study**
  - **Identified MSP, SEA, and SFO as airports for high payoff studies**
  - **Results integrated into the planned completion of TAP AILS research**

DRAFT

Analysis of the Role of ATC in the AILS Process

NASA Ad Hoc Team Report
on
ATC in IMC Close Parallel Runway Operations

Marvin Waller, Editor

May 1998

DRAFT

NASA/CR-1998-207675

Air Traffic and Operational Data on Selected U.S. Airports With Parallel Runways

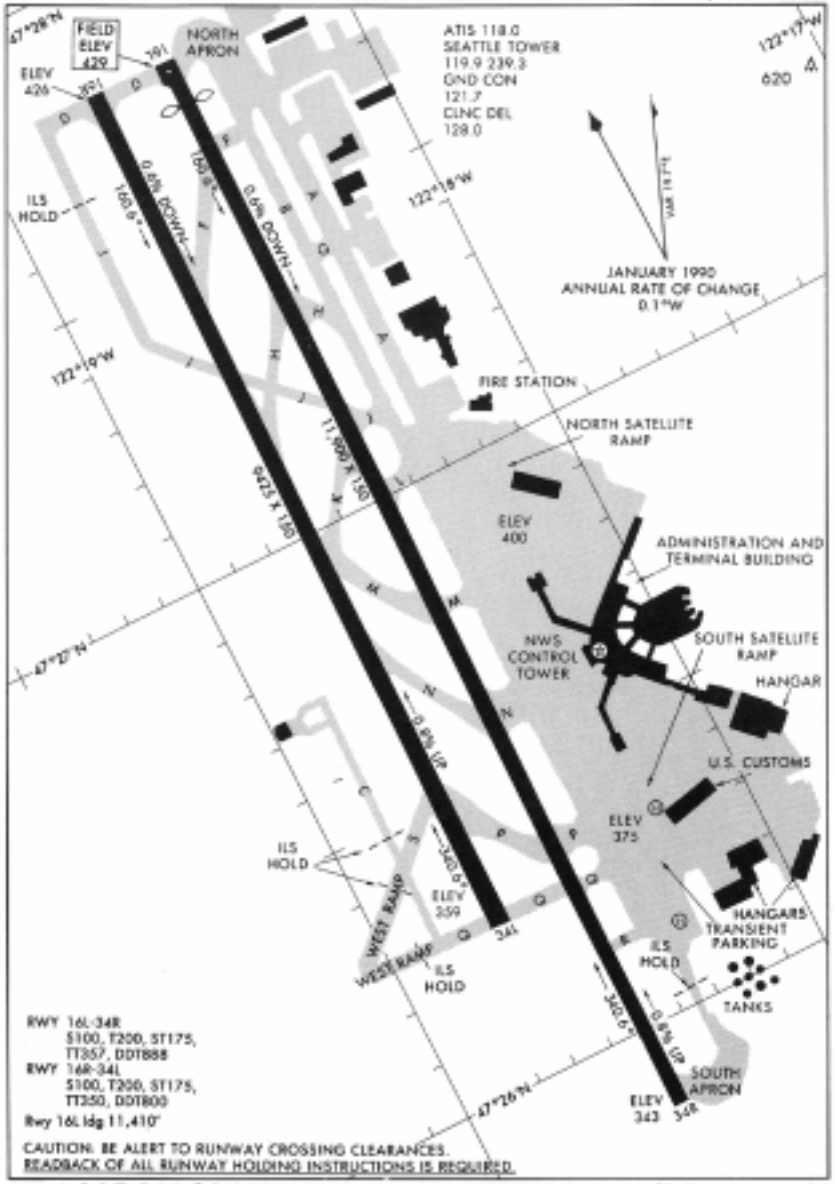
T. M. Doyle
Adsystech, Inc., Hampton, Virginia

F. G. McGee
Lockheed Martin Engineering & Sciences, Hampton, Virginia

May 1998

AIRPORT DIAGRAM

SEATTLE-TACOMA INTL (SEA)
SEATTLE, WASHINGTON



AIRPORT DIAGRAM

SEATTLE, WASHINGTON
SEATTLE-TACOMA INTL (SEA)

Airport: Seattle-Tacoma International Airport (SEA)

Hub airlines: Alaska and United

Airport average daily operations: 1043

Spacing between parallel runway centerlines:

- RWY 16L/R 800 ft

Type of radar system used at the airport: ASR-9

Type and number of tower radar displays: DBRITE 2

Number of local control positions: 1

TRACON serving airport: Seattle

- TRACON arrival control positions: 1
- TRACON final monitor positions: 2 running approaches to Boeing field during IMC

Weather conditions below which instrument approaches are required: Ceiling 3100 ft and/or visibility 4 miles

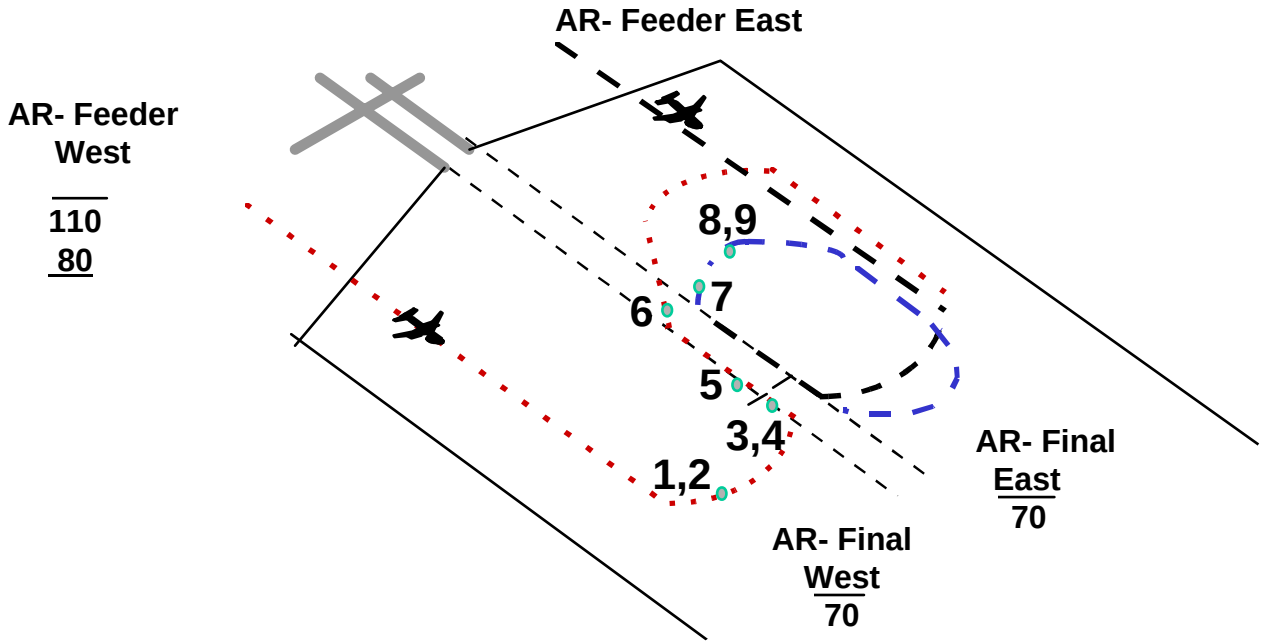
Usual or preferred flow of traffic: RWY 16L/R

Airport flow rate: 48 per hour

Arrival delay factors: None

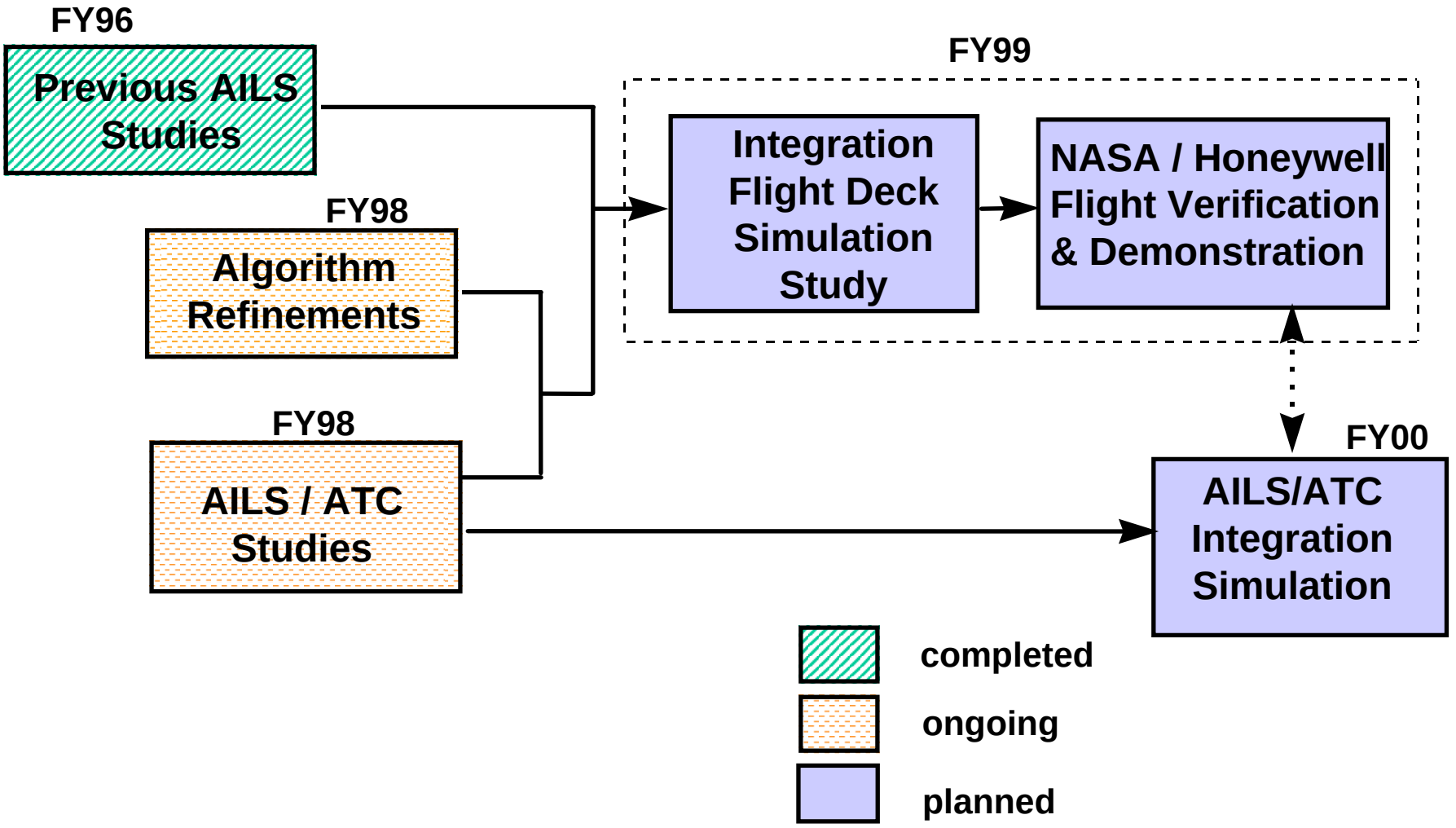
Remarks: Boeing field located 4 miles north. A new parallel runway is being planned west of RWY 16R and will be operational in 2001. Runway centerlines between the new runway and RWY 16L will be 2500 ft.

Example Blunder Scenario Analyzed to Derive Aircraft-ATC Interaction



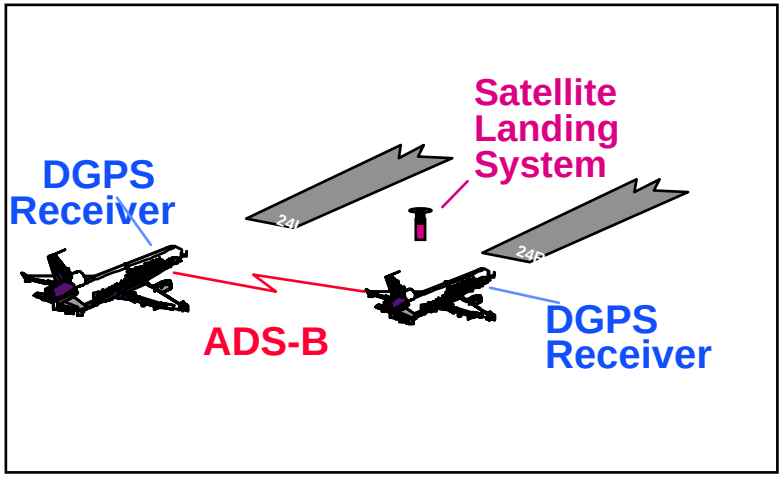
1. The final controller (AR-Final) points out traffic to both airplanes prior to turning final
2. Pilots will confirm traffic in view (AILS display) prior to receiving approach clearance
3. AR-Final will apply standard separation until issuing AILS approach clearance
4. AR-Final issues AILS approach clearance, lateral separation responsibilty given to flight
5. Communication transferred to tower local controller
6. Alerts provided to controllers as well as the flight deck
7. Initial resolution of the intrusion managed by the evading flight
8. Controller resumes separation responsibility when targets are separated
9. Flights sequenced back into pattern at controller's discretion, tower / TRACON coordination required

AILS Research Flowchart



Planned Flight Test

<u>Objective</u>: Verify the airborne system and components in end-to-end testing in a flight environment



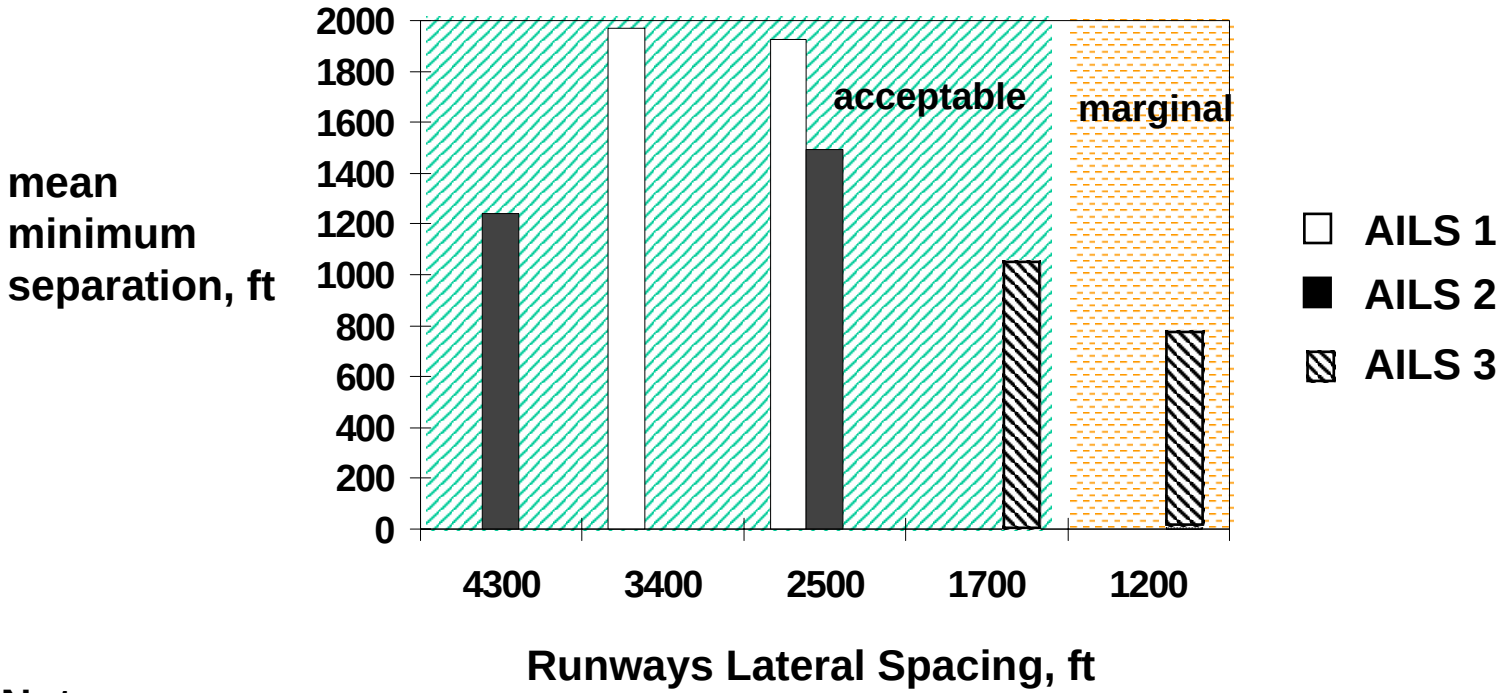
- **September 1999**
- **Preceeded by simulation study, 4/99**
- **Partnership with Honeywell**
- **NASA B757 and Honeywell G-IV**
- **Initially at Wallops**
- **Exploring revenue airport opportunity**

AILS Products at Program Completion

- **Concept to enable 2500 ft. runway spacing developed and validated in simulation and flight tests**
- **Documented detailed AILS/ATC integration paradigms with customer and stakeholder input incorporated**
- **Technology transferred to industry**
  - **One avionics vendor is currently investing significant capital to develop and certify a commercial product.**

Mean Minimum Separation During Intrusions

(Results of three simulation tests)



Note:

AILS 1 - Pilot response to alert: climbing turn to 45º delta heading. No guidance.

AILS 2 - Presented TCAS like guidance, but in 2D.

AILS 3 - Current baseline, similar to AILS 1 but improved alerting algorithm and flight director guidance provided.